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Troubleshooting Fault Tolerance (FT) in MS Windows NT

Abstract: This article walks you through the four areas in which problems are encountered in Microsoft Windows NT fault tolerant file systems: mirrors, stripe sets, volume sets, and FT sets. Each section contains the most commonly reported problems and a series of steps to take to correct the condition or isolate its cause. A section at the end lists articles in the Microsoft Knowledge Base that treat in more detail the topics covered procedurally in this article.

Mirrors

Cannot Establish Mirrors or Option Grayed Out

- In Disk Administrator, highlight the partition you want mirrored: hold down <ctrl>, select drive you wish to be the shadow. Go to the Fault Tolerance menu and select Establish Mirror.
- Check to see if there is enough space on the shadow drive. If you are mirroring the whole drive, make sure the primary and shadow drives are the same size and have the same number of cylinders, sectors and heads.
- If there has been a partition on the shadow drive, delete it and go to the Partition Menu in Disk Administrator and select Commit Changes.
- Make sure the free space is equal to or greater than the size of the primary drive.
- If FTDisk does not start, check for a corrupt FTDISK.SYS.

Mirror Set Does Not Initialize or Keeps

Breaking

If drives are external

- Check cables for bad or loose connections.
- Make sure the terminator is attached correctly to last physical device on the chain.
- Make sure the SCSI chain is no longer than six meters.
- Remove extra **devices** such as tape drives and scanners.
- Slow down the transfer rate of the host bus adapter (HBA). For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.

If drives are internal

- Check internal cable for loose, or bad connections.
- Make sure HBA is terminated, if SCSI **devices** are on both (internal and external) leave termination off the card and make sure both ends of the chain are terminated properly.
- If there are no external **devices** on the chain, leave termination ON at the HBA. Remove extra **devices** such as tape drives and scanners.
- Slow down the transfer rate of the HBA. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.

Other things to check

- If you are duplexing, make sure **BIOS** is enabled on the primary drive's SCSI HBA and disabled on the shadow drive's controller.

Check the NT event log for:

- Event ID 9 (driver detected a controller error...). This is usually caused by an old or bad driver or outdated firmware on SCSI HBA
- Event ID 11 (SCSI bus **time-out**.....). This can be caused by a device on the chain hogging the bus. Example: a tape drive during backup.
- If using a PCI HBA, make sure it is in the primary slot.
- If you are duplexing and **BIOS** is enabled on the primary HBA, turn the **BIOS** off on the shadow drive HBA.
- Check the medium: run a low level format and then verify the hard drive with the HBA. Try a different hard drive.
- Make sure the primary and shadow hard drives are the same make and size; differences can prevent booting off the mirrored bootsector. When drives are not the same size, the shadow drive's partition is created to be larger than the primary's partition by at least one MB. Windows NT creates the shadow

partition based on the primary drive's numbers, then copies over the boot sector. Drives that are not the same type and size have a different drive geometry, so even though the system is mirrored, the shadowed bootsector has incorrect information and you cannot boot off it without a floppy. Trying to mark it active and booting from the hard disk, either hangs the system after the SCSI **BIOS** or generates the error message "Cannot find NTLDR."

Cannot Boot To Shadow Drive

Understanding the ARC path is the key to booting a computer with a failed primary drive. Below each part of the syntax is described:

ARC path syntax

- **multi** is the adapter's ordinal number. For example if there are two SCSI adapters in the system, the first to load and **initialize** is assigned 0 and the next is assigned 1, and so on for all of the adapters in the machine. Remember, the HBA **BIOS** must be turned on to use multi syntax.
- **SCSI** was used in the 3.1 versions of NT before NTLDR was enabled to scan for the HBA's **BIOS**. The syntax and ordinals are the same as they are for multi, but the SCSI driver must be copied to the root of the boot drive (or root of floppy if booting from the FT floppy) and renamed to NTBOOTDD.SYS.
- **disk**: for SCSI syntax this is the SCSI ID of the disk; for multi it is always 0.
- **rdisk**: for SCSI syntax this is always 0; for multi it is the ordinal of the disk—that is, the order in which the disk appears in Disk Administrator (disk 0, disk 1 ,.....).
- **partition**: the partition where NT is installed. Partition numbers begin with 1, not 0.

Other items to check

- Make sure the primary and shadow SCSI IDs are consecutive (for example: 0,1). This is not necessary, but it facilitates recovery from a failed primary by allowing NT to scan immediately to the next available drive on the chain for booting.

Consider this configuration:

Primary drive	SCSI ID 0	(boot device with OS)
CD-ROM drive	SCSI ID 2	(cannot be boot device)

Data drive	SCSI ID 3	(1 GB HD with data)
Shadow drive	SCSI ID 4	(mirror of C:)

- Make sure the FT floppy has been formatted under Windows NT and has the files NTDETECT.COM, NTLDR, and BOOT.INI.
- If the FT floppy is a diskcopy of the Setup boot disk, make sure NTLDR has been renamed to SETUPLDR.BIN.
- If you are not duplexing, use the FT floppy with the original BOOT.INI (remember to use consecutive ID's (0,1)) but make sure to remove the failed drive from the SCSI subsystem.
- If you are duplexing, you can remove the failed drive and place the shadow as ID 0 on the primary controller, boot from the FT floppy with the original BOOT.INI (multi(0)disk(0)rdisk(0)partition(1)).
- If **BIOS** is disabled on the controller, you can enable it or you can use SCSI syntax in the BOOT.INI. SCSI syntax requires that the Windows NT SCSI driver be in the root of the FT floppy NTBOOTDD.SYS. Here is the SCSI notation that directs a boot from the shadow drive of NT mirrored to the first HD (SCSI ID 0) with Windows NT on the second partition and attached to the second HBA:

scsi(1)disk(0)rdisk(0)partition(2)\winnt35

If mirroring.....

- Make sure the primary and shadow SCSI IDs are consecutive (for example: 0,1) if they are on the same controller. This is not necessary, but it facilitates recovery from a failed primary by allowing NT to scan immediately to the next available drive on the chain for booting.

Consider this configuration:

Primary drive	SCSI ID 0	(boot device with OS)
CD-ROM drive	SCSI ID 2	(cannot be boot device)
Data drive	SCSI ID 3	(1 GB HD with data)
Shadow drive	SCSI ID 4	(mirror of ID 0)

If the primary drive fails , Windows NT cannot boot with the BOOT.INI at the original settings Multi(0)Disk(0)Rdisk(0)Partition(1) \. NT first looks for ID 0, but that has failed and been removed. It tries the next Device in the SCSI chain, the CD-ROM drive, which is not a bootable device. It tries the next

one in line and finds a hard disk (data drive), which is bootable but does not contain the operating system. Had the shadow drive been set to SCSI ID 1, NT would have moved to it first and would have been able to reboot quickly after the failure of the primary.

If Duplexing.....

If duplexing (two controllers) the SCSI ID's can be any number as long as they are unique to that HBA. It is best to keep them at the same ID's so they can be easily identified by someone who did not establish the mirror or install the hard drives. Again, this is not required but can facilitate recovery.

Consider this configuration:

Primary adapter: (**BIOS** enabled)

Primary drive	SCSI ID 0	(boot device with OS)
CD-ROM drive	SCSI ID 2	(cannot be boot device)
Data drive	SCSI ID 3	(1 GB HD with data)
Data drive	SCIS ID 4	(1 GB HD with data)

Secondary adapter: (**BIOS** disabled)

Shadow drive	SCSI ID 0	(Mirror of boot drive)
Data drive	SCSI ID 2	(1 GB HD with data)
Data drive	SCSI ID 3	(1 GB HD with data)
Tape drive	SCIS ID 4	(Backup device)

To boot off the mirror drive in this situation, we cannot use multi syntax, since the **bios** is disabled so scsi syntax comes in the picture. The boot.ini for this configuration would be scsi(1)disk(0)rdisk(0)partition(1)..... Remember, you must have your scsi driver renamed to ntbootdd.sys in the root of your FT boot floppy.

Note Some EISA machines make you specify which adapter is bootable if more than one is present in the system. If this is true, the above example will not work with SCSI syntax. You must enter your EISA config and change the boot order to the secondary controller, turn the **BIOS** on and disable the **BIOS** on the controller that you just switched to non-bootable. This will then make the secondary adapter in the above example **initialize** first. The boot.ini will then read:

multi(0)disk(0)rdisk(0)partition(1).....

Please consult your hardware vendor for the above procedure.

Booting to Shadow Drive on RISC-Based Computer

Alternate boot selections on RISC machines

RISC based machines such as the MIPS, Alpha and PowerPC running Windows NT do not use a BOOT.INI file to display boot selections. Instead, you can use tools in system firmware to create, delete, and edit boot selection options. RISC-based machines also differ from x86-based machines in that they boot from system firmware and have no built-in way to boot from a floppy drive. If the primary drive in a mirror set fails on a RISC machine, you must create alternate paths in system firmware in order to boot the machine to the shadow drive in the mirror set. There are two ways to do this:

Boot from a floppy

A fault tolerant floppy for a RISC machine must have a directory called \os\winnt351. Most RISC machines require that the winnt351 directory contains the two files OSLOADER.EXE and HAL.DLL

AXP machines require that this directory contain several additional files (of extension .PAL) on the system partition. Once the FT floppy has been created, follow the steps below to create an alternate boot selection in the firmware. Select or enter the options in **bold type**.

1. Select a system partition for this boot selection:
SCSI Bus 0 Hard Disk 0 Partition 1
New system partition
2. Enter location of system partition for this boot selection:
Select Media:
SCSI Hard Disk
Floppy Disk
CD-ROM
3. Enter floppy drive number: **0**
4. Enter the osloader directory and name: **\os\winnt351**
\osloader.exe
5. Is the operating system in the same partition as the osloader:
Yes
No
6. Enter the location of OS partition:
Select Media:
SCSI Hard Disk

Floppy Disk
CD-ROM

Enter SCSI bus number: **0**

Enter SCSI ID: **2**

Enter Partition: **2**

7. Enter the operating system root directory: **\winnt35**
8. Enter a name for this boot selection: **Boot Shadow Drive**
9. Do want to **initialize** the debugger at boot **time**:
Yes
No

Add a boot selection without a FT floppy

After a primary drive failure, you can boot a RISC machine without a FT floppy if *before* the drive failed you:

- mirrored the system partition (which contains the NT system files)
- mirrored the small FAT partition
- added an alternate boot selection in the firmware.

Performing these steps (follow the procedure below) also allows you to test the Fault Tolerance of the system easier. Select or enter the options in **bold type**.

1. Boot the system and from the System boot menu, select **Supplementary menu**
2. From the supplementary menu select **Setup the system**.
3. From the Setup Menu select **Manage boot selections**.
4. From this menu, select **Add a boot selection**, and follow these steps:
5. Select a system partition for this boot selection:
SCSI Bus 0 Hard Disk 0 Partition 1
New system partition
6. Enter location of system partition for this boot selection:
Select Media:
SCSI Hard Disk
Floppy Disk
CD-ROM

Enter SCSI bus number: **0**

Enter SCSI ID: **2**

Enter Partition: **1**

7. Enter the osloader directory and name: **\os\winnt351**
\osloader.exe
8. Is the operating system in the same partition as the osloader:
Yes

No

9. Enter the location of OS partition:

Select Media:

SCSI Hard Disk

Floppy Disk

CD-ROM

Enter SCSI bus number: **0**

Enter SCSI ID: **2**

Enter Partition: **2**

10. Enter the operating system root directory: **\winnt35**

11. Enter a name for this boot selection: **Boot Shadow Drive**

12. Do want to **initialize** the debugger at boot **time**:

Yes

No

See **Knowledge Base article Q139333** for more information on booting RISC-based machines

Stripe sets

Cannot Establish Stripe Set (With or Without Parity) or Option Not Available

A partition containing system files cannot be a member of stripe set.

For a stripe set with parity, you must select three or more disks with free space. For a stripe set without parity you must select two areas of free space on two different physical disks.

Cannot Initialize Stripe Set

If drives are external

- Check cables for bad or loose connections
- Make sure the terminator is attached correctly to the last physical device on chain.
- Slow down the HBA transfer rate. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.
- Make sure the SCSI chain is no longer than six meters.
- Remove extra **devices** such as tape drives and scanners.

If drives are internal

- Check internal cables for loose, or bad connections

- Make sure the HBA is terminated; if SCSI **devices** are on both (internal and external) leave termination off the card and make sure both ends of the chain are terminated properly. If there are no external **devices** on the chain, leave termination ON at the HBA.
- Slow down the transfer rate of the HBA. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.
- Remove extra **devices** such as tape drives and scanners.
- Make sure SCSI chain is not longer than six meters.
- If the FTDisk fails to start, check for a corrupt FTDISK.SYS file.

Cannot Regenerate Stripe Set with Parity; Disk Administrator Message "Drive cannot be locked for exclusive use"

- Make sure PAGEFILE.SYS is not on the volume that is a stripe set with parity.
- Stop all services running on the volume (SMS, SQL, SNA, etc.)
- Make sure users are not connected to shares or home directories on the volume.

Stripe Set with Parity Keeps Failing

If drives are external

- Check cables for bad or loose connections
- Make sure a terminator is attached correctly to the last physical device on the chain.
- Slow down the transfer rate of the HBA. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.
- Make sure the SCSI chain is no longer than six meters.
- Remove extra **devices** such as tape drives and scanners.

If drives are internal

- Check internal cables for loose, or bad connections
- Make sure the HBA is terminated; if SCSI **devices** are on both (internal and external) leave termination off the card and make sure both ends of the chain are terminated properly. If there are not any external **devices** on the chain, leave termination ON at the HBA.
- Slow down the transfer rate of the HBA. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.
- Remove extra **devices** such as tape drives and scanners.

Regeneration option grayed out

- In Disk Administrator, highlight the Stripe set w/ parity, hold down <ctrl> , select new drive that contains the free space, then select Regenerate.
- If the newly added drive is not online, check cables, termination, and connections to drive.
- Stripe sets without parity are not fault tolerant. When one disk of the set is lost, the data on the others is not recoverable.

Volume Sets

Cannot Establish Volume Set

If drives are external

- Check cables for bad or loose connections.
- Make sure a terminator is attached correctly to the last physical device on chain.
- Slow down the transfer rate of the HBA. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.
- Make sure the SCSI chain is no longer than six meters.
- Remove extra **devices** such as tape drives and scanners.

If drives are internal

- Check internal cable for loose, or bad connections.
- Make sure HBA is terminated; if SCSI **devices** are on both (internal and external) leave termination off the card and make sure both ends of the chain are terminated properly. If there are not any external **devices** on the chain, leave termination ON at the HBA.
- Slow down the transfer rate of the HBA. For example, try 5.0 MB/s; set it through the HBA's **BIOS** on the card.
- Remove extra **devices** such as tape drives and scanners.
- Make sure that no partition containing system files is a member of a volume set.

Cannot Access Volume Set in File Manager

1. If the volume set is newly created, make sure it is formatted. Only extensions of volume sets are formatted automatically.
2. Make sure FTDISK is started. Go to Control Panel/**Devices** to make sure that it is set to start at boot, not system.

3. Use Disk administrator to check the volumes. If they show up as **unknown**, you can reload the configuration through Disk Administrator if you have saved it to a floppy after creating the sets. If you do not have a backup copy, you can use FTEDIT to enter the configuration into the registry. You can get FTEDIT from the *Windows NT 3.51 Resource Kit* (available on TechNet) or by calling Microsoft Product Support Services

Invalid Size Error When Extending a Volume Set

To extend a volume set, highlight Volume set and the free space while holding down <ctrl> and select Extend volume set. When the first dialog prompts you for the volume size, enter the total size of the volume set, not the amount by which you would like to increase it. If, for example, you have a volume set made up of two 100-MB drives and you add a 50 MB drive to extend the volume set, a message pops up that the new size will be 250 MB. Enter 250 in this box, not 50.

FT sets

FT Sets Show Up As Unknown

1. Check to see if FTDISK is starting at **Boot**. If it has been set correctly, check the NT event log to see if FTDisk failed. Shut down Windows NT before trying to start the service, or you could crash the system. Change the startup options in Control Panel/**Devices** from **Disabled** to **Boot** and restart NT.
2. If you have saved out the disk configuration to a floppy in Disk Administrator, reload the configuration into the registry using Disk Administrator. If not, use FTEDIT to recover FT information in the registry.
3. If you have saved out the disk configuration to a floppy in Disk Administrator, restore the DISK key from the Configuration option in Disk Administrator to correct possible DISK key corruption. If not, use FTEDIT to recover the FT information.

FT Sets Show Up as Unknown after NT Re-installed

All FT information is kept in the DISK key in the registry at HKEY_local_Machine \System. When NT is re-installed, this key is newly created and has no information about the FT sets in the SCSI

subsystem. If you have saved out the DISK key on floppy use Disk Administrator to restore the configuration. If you install to a new directory, search for the Configuration. Otherwise, use FTEDIT to recover the FT sets.

More Information

On TechNet

FT KB articles

Q113932	Windows NT Fault Tolerance and the Boot and System Partitions
Q101702	Problems Booting from Shadow Set Secondary Member
Q107238	Fault Tolerance Errors on Striped Set with Parity
Q130930	Creating a Boot Floppy for a Multibus SCSI Adapter
Q124958	NTFS Integrity Problems with Large Stripe Sets
Q135061	Regeneration of a Stripe Set With Parity Disk Fails
Q129043	Repair Fails When Mirrored Drive is Two Gigabytes or Larger
Q111348	Stripe Set with Parity Incorrectly Displays RECOVERED
Q130921	Creating an FT Boot Disk With Scsi() and Multi () Identifiers
Q114872	Restoring Disk Configuration Information
Q129038	Summary of Windows NT NTFS and FTDisk Data Recovery
Q129042	Alternate Methods of Booting from a Failed Mirror
Q136425	Err Msg: The Drive Cannot be Locked for Exclusive Use
Q117131	Master Boot Record Not Written to Mirrored Shadow Partition
Q108304	Recovering from Loss of FT Disk Configuration Information

Q113977	Booting From Mirror After Primary Partition Is Lost
Q113503	Overview of Disk Volume Sets in Windows NT

NT Backup KB articles

Q101228	Backup: /MISSINGTAPE Command Line Switch
Q104167	Formats that Windows NT Backup Reads from and Writes to
Q110149	NTBACKUP: Fails to Detect Network Failure
Q113047	Incomplete NTBACKUP Directory Listing
Q128234	Scheduling Windows NT Backup Fails and Locks Backup Process
Q123717	Windows NT Backup Writes Incorrect Times To Log
Q112218	Scheduled NTBackup Must Be Configured Using System Account
Q137287	Windows NT Backup Causes Access Violation When Started
Q105800	Backup Program Loops Indefinitely
Q114734	NTBACKUP Fails When Backing Up and Restoring Over the Network
Q104291	Using Windows NT Backup to Backup Removable Media
Q105569	Backup Fails and Reports Fatal Hardware Error on Tape Device
Q110154	Access Violation in Backup
Q138116	NTBACKUP Cannot Catalog and Restore Compressed Data from Tape
Q130909	NTBACKUP Fails to Restore All Files in a Directory
Q118772	Err Msg During Backup: Fatal Error on Drive 1
Q122533	NTBACKUP Ignores Registry Settings After You Apply Service Pack

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